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Beyond Notebooks: Interactive Data visualization with dashboards

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Hi, I'm Nico Kreiling

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- Major focus fields:
  - Natural Language Processing (NLP)
  - Recommender Systems (RecSys)
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Conference Talk Archive

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Agenda

- 😇 Notebooks 😈
- Use Cases for Dashboards
- Framework Comparison
  - Streamlit
  - Panel
  - Voila
- Summary

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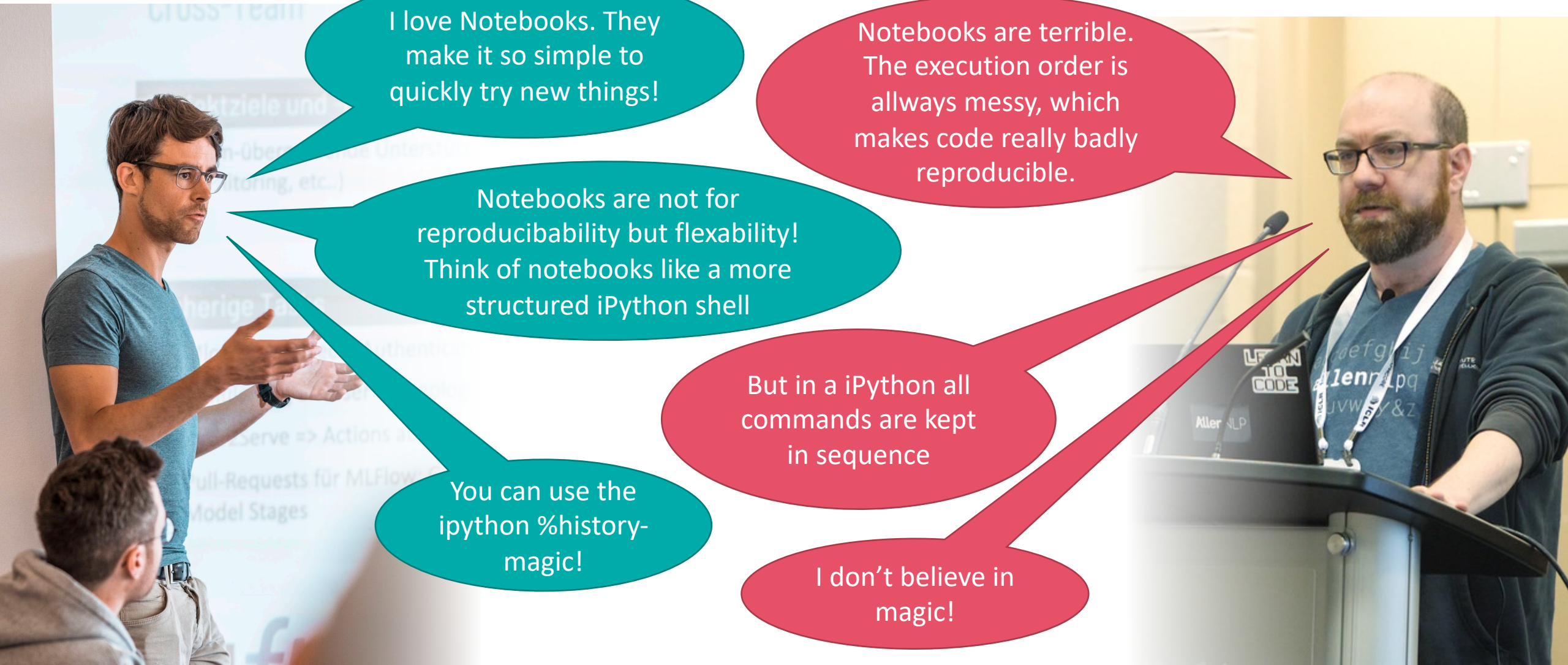
 Notebooks 

Notebooks for science



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Notebooks for software engineering

Notebooks don’t have valueable features such as linting, type-checking and auto-completion

Notebooks aren’t there to write complex code

Notebooks are not even properly usable in version control

Still: Notebooks aren’t there to write complex code, such as class structures

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Notebooks for learning and exploration

Notebooks are great for learning!

But it gives users the possibility to play with data and change them interactively!

You can also write bad code in an editor!

Absolutely not! They have lot's of hidden information, which makes it very hard to create good code!

But notebooks encourage bad programming practices!

Guys - what about dashboards?

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Notebooks / Dashboards Pro's and Con's

	Notebooks are great at…	Notebooks fail…
Dashboards +	Combining data with general information (markdown) Data visualizations Data exploration	To ensure reproducability Providing a restricted access to data For non-technical users
Dashboards -	As interactive computing environment teaching to code	For proper software engineering

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Usecases for Dashboards

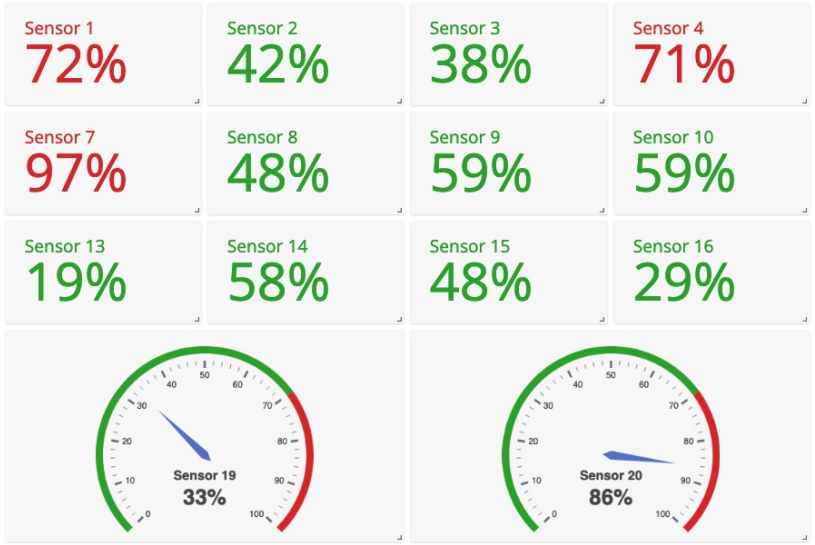
What is a Dashboard?

A **dashboard** is a type of graphical user interface which often provides at-a-glance views of key performance indicators (KPIs) relevant to a particular objective or business process.

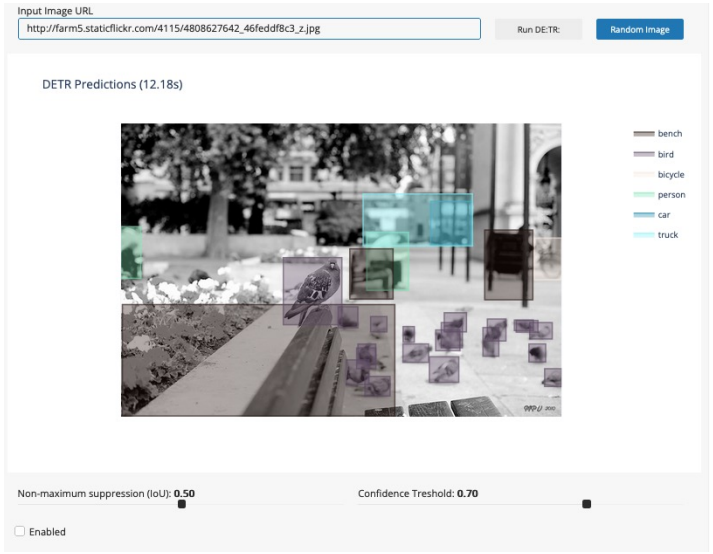
In other usage, "dashboard" is another name for "progress report" or "report" and considered a form of data visualization. In providing this overview, business owners can save time and improve their decision making by utilizing dashboards.

https://en.wikipedia.org/wiki/Dashboard_(business)

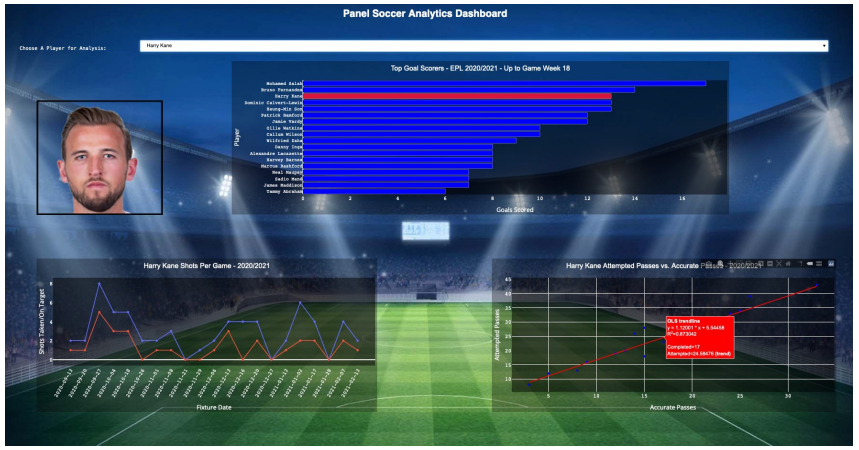
Use Cases for Dashboards



Monitoring Streaming Data



Interactive (ML) Demos



Analytical Dashboards

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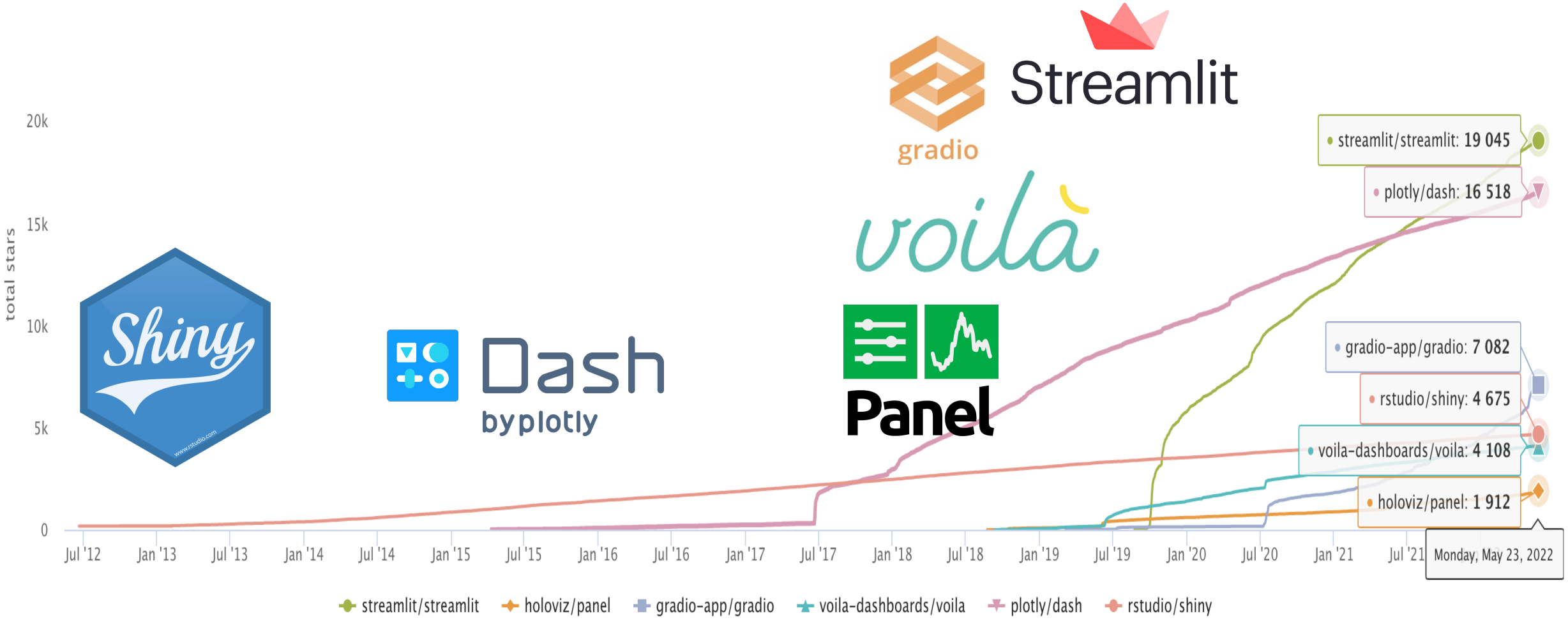
What dashboards to exist



Which dashboard tools are out there?

Name	Stars	Contributors	Downloads	License	Sponsors	Built on
bokeh	16k	393	pypi 3M/month · conda 541k/month	BSD-3-Clause	NUMFOCUS, ANACONDA.	bokeh
dash	17k	98	pypi 862k/month · conda 26k/month	MIT	plotly	plotly
streamlit	19k	129	pypi 1M/month · conda 6k/month	Apache 2	Streamlit	-
panel	1.9k	93	pypi 464k/month · conda 63k/month	BSD	ANACONDA.	bokeh
gradio	7k	60	pypi 265k/month · conda 0/month	Apache License 2.0	Hugging Face	-
visdom	9.1k	94	pypi 64k/month · conda 1k/month	CC-BY-NC-4.0	-	plotly
voila	4.1k	55	pypi 39k/month · conda 5k/month	BSD	QuantStack	-

Source: https://pyviz.org/tools#dashboarding

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Voila

- Open Source library to transform any Jupyter notebook into a dashboard
- Also works for some non-python kernels
- Mostly used together with Jupyter widgets
- Minimal learning curve
- Sponsored by QuantStack

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Voila Workflow

- Create a notebook using ipython-widgets
- Convert the notebook into a dashboard using `voila notebook.ipynb`

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Streamlit

Many examples at Awesome streamlit

- Python library (open source)
- But also a start-up which was aquired by snowflake recently
- Easy to use with enhanced caching and storage options
- Provides an own cloud for deployment

Streamlit workflow

- Create a dashboard.py file and `import streamlit as st`
- Use streamlit components for inputs and outputs
- Use `streamlit run dashboard.py`

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Panel

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Panel

Many examples at Awesome panel

- Python library on top of param
- Allows usage within a notebook
- Provides multiple APIs
  - Interact: automatifcally create UI controls by using type inference
  - Widgets, Templates & Pipelines: Fine grained control to build complicated dashboards
- Part of a bigger eco-system, fully sponsored by Anaconda

HoloViz-maintained libraries

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Panel Workflow

- Use-case 1: Easy Notebook usage
  - Call `pn.extension()`
  - Use `pn.interact` to transform any function into a minimal dashboard
  - Use `pn.serve()` to start a full-screen dashboard
- Use-case 2: Create a production dashboard
  - Create a file such as dashboard.py and import panel
  - Create a class that inherits from `param.Parameterized`
  - Instantiate that class
  - Run `panel serve app.py`

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Comparison & Summary

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Comparison

	Voila	Streamlit	Panel
Programming Languages	Python, C++, Julia	Python	Python
Notebook Support	Yes	No	Yes
Design flexiablity	Templating system, but not the main focus	Limited but easy theme editor	Powerfull Templating system using Bootstrap / Material-Design
Deployment	Documentation for multiple providers (GCP, Binder, Heroku..)	Streamlit cloud	Documentation for multiple providers (Azure, GCP, Binder, Anaconda, Herokus..)
Community + Support	Popular, but bit less active	Very popular and active	Small, very personal community
Strength	Multi-Language Support Tight Jupyter Coupling	Ease-of-use Beautiful by default	Very flexibel Multi-Page-Support

More information

- Read: A detailed comparison of Voila, Streamlit, Panel and Dash
- Video PyData Workshop with the authors of those Dash, Voila, Panel and Streamlit
- Code can be found at: https://github.com/krlng/py-dashboarding/tree/main/training

- Or reach out to me:


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